

Metacognition in Secondary Science: Developing, piloting and reviewing a metacognitive intervention for pupil premium students in secondary science.

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Background
Metacognition can be conceptualised as being consciously aware of your learning, including the planning, monitoring and evaluation phases^[1]. As individuals reach adolescence their metacognitive abilities are seen to mature^[2], likely due to the increased neuroplasticity at this age^[3]. Highly metacognitive peers academically outperform less metacognitive peers regardless of overall aptitude^[4] and are better prepared for careers in the 21st century^[5]. Metacognitive interventions have also been shown to support students in making seven months academic progress^[1], as well as becoming more autonomous learners^[6] and enabling students to have a deeper understanding of academic concepts^[7]. Interventions targeting metacognitive abilities in students have been shown to be effective in many secondary subjects^[8], however there is currently no intervention available to the public in the field of secondary science. Therefore the Metacognition in Secondary Science (MiSS) intervention was developed to support metacognitive development in this area. This intervention runs for 14 sessions across 7 weeks, and incorporates current GCSE science topics alongside evidence-based metacognitive strategies.

The Metacognition in Secondary Science (MiSS) intervention was designed to address the gap of evidence based, publicly- available, metacognitive interventions in secondary science. This study included piloting of the intervention and empirical measures with six, Year 10, Pupil Premium students by a trained teaching assistant. Further to this the MiSS intervention was reviewed by a group of trained teaching assistants and expert science teachers in order to determine the perceived barriers and facilitating factors within the intervention. Initial results from the pilot study and review suggest that the MiSS intervention can be practically implemented in a secondary setting and that the intervention has strengths in its organisation, content and design.

Reviewing the MiSS Intervention
Three teaching assistants (TAs) trained in delivering the intervention and six science teachers were asked to review the MiSS intervention. TAs were also asked to review the training they received. The intervention was reviewed using separate questionnaires for each participant group, with each questionnaire including Likert scales and open response questions. Following training TAs reported an increase in their scientific knowledge, understanding of metacognition, knowledge of metacognitive strategies and confidence and competence in delivering the intervention. They also rated all aspects of the

Piloting the MiSS intervention
Three consenting teaching assistants (TAs) received training in the MiSS intervention, with one TA then delivering the intervention to a group of six Year 10 Pupil Premium students. Piloting demonstrated the feasibility of implementing the intervention, as well as highlighting its deliverability by a TA. Further to this the pilot study allowed the measures used to be assessed for suitability. The self-report measure used by students to assess their metacognitive strategy use was found to have high internal consistency with a Cronbach alpha score of $\alpha = .710$.

Implications for Practice
1. Educational Psychologists (EPs) should promote metacognitive strategy use in schools. This can be done through targeted student interventions and teacher training.
2. EPs should consider implementation practicalities when recommending evidence-based interventions to schools.
3. EPs should consider the importance of training teaching assistants when asking them to deliver specific interventions in order to improve their competence and confidence.

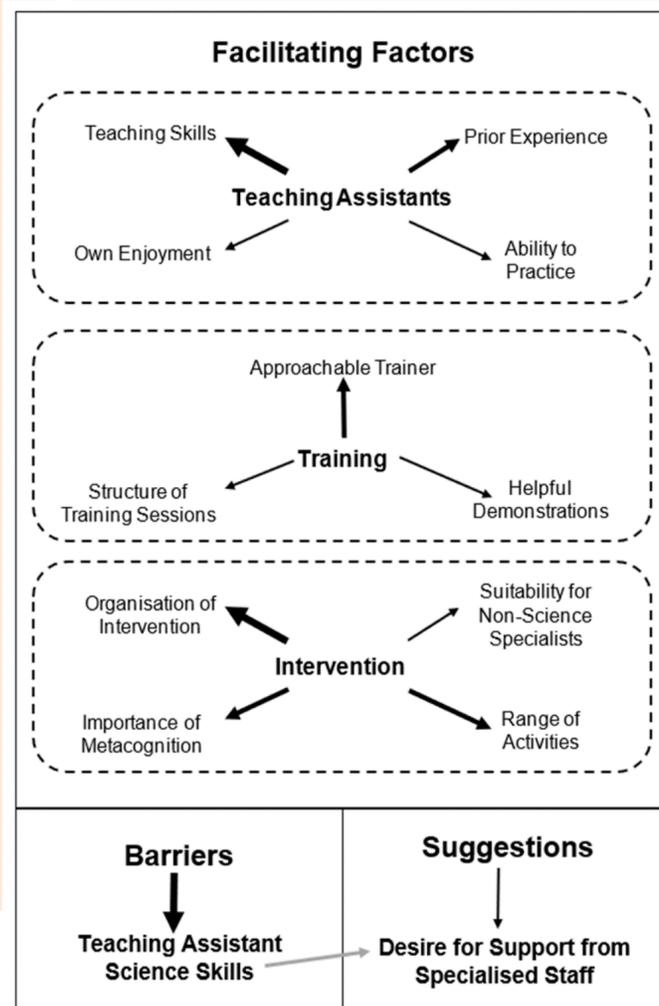


Figure 1. TA thematic map

MiSS intervention to be “Good” with session activities, content and student engagement to be “Very Good”. Science teachers reviewed the intervention to be appropriate for the secondary setting, and delivery by TAs as well as stating that they “Agree” with the appropriateness of the six science topics included. Thematic analysis^[9] was undertaken on open responses from TAs and science teachers, with the resulting thematic maps being shown in Figures 1 and 2, respectively. Both groups valued the intervention layout and content with science teachers highlighting the strengths in specific metacognitive and teaching strategies included. Science teachers felt that practicalities of delivery, such as time and staff availability, may act as barriers to delivery. Teaching assistants raised concerns about their own scientific knowledge as a barrier to delivery, however the science teachers did not consider this as a barrier instead highlighting it as a strength of the MiSS intervention.

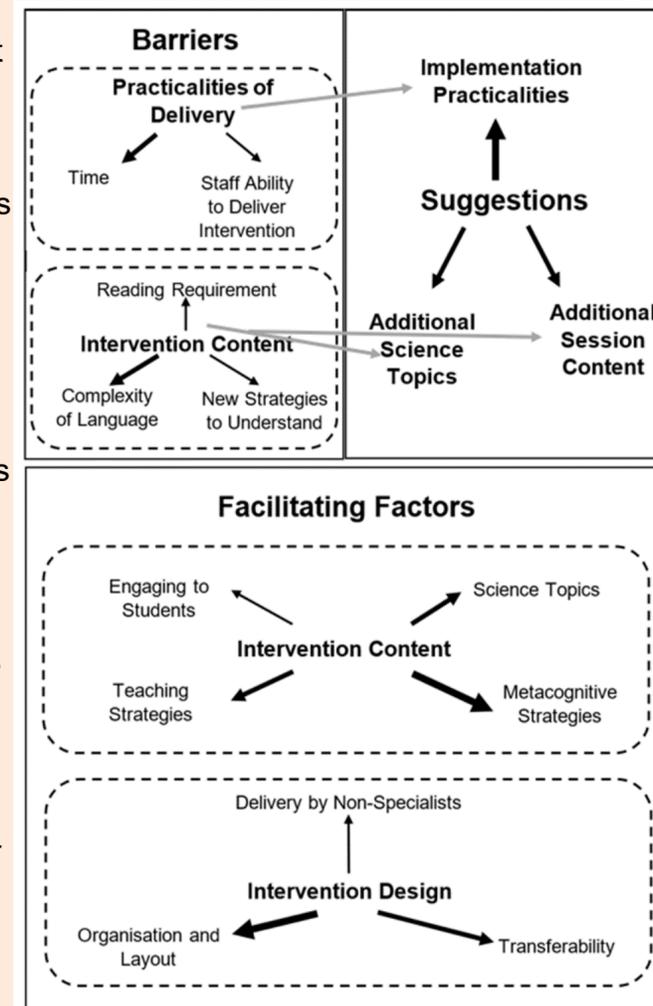


Figure 2. Science Teacher thematic map



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